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Abstract*: industry is one of the main resources of a country's economic development. Different types of industries have different system of production. For production purpose these industries use a huge amount of chemicals and raw materials which rapidly polluted surface water of our country in the form of effluent. The aim of this study was to assess the water quality status of Turag river due to industrial effluent. This study was in Tongi heavy industrial area and investigation was done by collecting effluent from four industries and three stationery point on turag river which was selected by purposive sampling technique. The values of DO of the analyzed industrial samples are within the range of 2.32-6.28. In chemical industries DO value is lower than the standard. But in other conditions DO value is higher. DO value of the river is also lower than the Bangladesh standard. Dissolve oxygen (DO) values are found in the range from 1.85 to 4.20 mg/L . The highest value 29 6 mg/L for DO was found in 2006 decreased to 1.85 to 4.2 mg/L in the present study. Higher BOD values were found in Confluence Point of Turag river .The values BOD ranging from 13 to 73 mg/L. The permissible limit for BOD for drinking water is 0.2 mg/L, for recreation 3 mg/L, for fish 6 mg/L and 10 mg/L for irrigation. (Bangladesh standard) (DoE, Department of Environment, 1991, 1997). The biological oxygen demand (BOD) was high because most of the industries are situated near the bank of the river. They discharge organic material, e.g. from sewage treatment works, storm overflows, domestic waste water (human waste and food waste) and industrial waste water (from tannery, textile and food processing industries), agricultural slurry, silage liquor. Turag river is polluted by industrial effluent, untreated sewage, wastewater, oil dumping, silt, encroachment etc. Pollutants entering the water body are both in solid and liquid forms. Concerning all measured parameters (especially DO, BOD), it could be concluded that pollution of Turag water reached critical point with increasing tendency day by day. This study has revealed that the industries are involved in serious environmental hazard. Adequate preventive measures should be taken in industrial activities with a view to ensuring a healthy environment.*

Keywords: Water Quality, Turag River, Industrial effluent

1. INTRODUCTION

1.1 General

"No life without water" is a common saying, as water is the essential requirement of all life supporting activities. From different sources water can be obtained such as wells, ponds rivers, lakes etc. but unfortunately, clean, pure and safe water exists only briefly in nature and is immediately polluted by existing environmental factors and human activities and hence water from most sources is unsuitable for consumption and other purposes without some sort of treatment [1].

The uses of water in a community are many, and the requirement in quantity and quality are varied. The uses of water include domestic use, public purposes, industrial purposes, agriculture purposes etc.

Industry is a small user of water in terms of quantity but has a significant impact on quality. Over three fourth of fresh water draw by the domestic and industrial sector, return as domestic sewage and industrial effluents which inevitably end up in surface water bodies or in the ground water, affecting water quality [2]. Approximately 15,000 m3 of untreated chemical wastes are discharged to the low-lying areas, natural canals and other water bodies such as the Buriganga and Turag rivers, which are major sources of water supply for agricultural, livestock and fishing activities.

Turag is an important river. The Turag River is an upper tributary of the Buriganga River and originates from the Bangshi River that flows through Gazipur and joins with the Buriganga River at Mirpur, Dhaka. The catchment area of the Turag is located in the southern part of Modhupur, which covers 999.74 km2.[3] In September 2009, the DoE (Dept. of Environment) declared the Turag River to be in an ecologically critical condition based on the heavy pollution discharged by the industries in the area. The Turag represents an important feature of the Dhaka City lifestyle because of the abundance of fish. Unfortunately, the uncontrolled dumping of industrial waste from the industries located along the banks of the river has greatly increased the river water pollution to a very dangerous level. The majority of the industries have made little effort to follow environmental law, and the water has become visibly discolored [4].

The importance of the river Turag can be understood by knowing its contribution to Dhaka or to the whole country. The contributions are:

- Heart of economy.
- Helps to maintain ecological balance.
- Helps in communication.
- Helps in socio economic development.
- Helps in irrigation & cultivation.

1.2 Background of the Study

Dhaka is the capital of Bangladesh. The economy of Bangladesh is mostly depending on it. Dhaka city is surrounded by a number of rivers and canals of which Turag, Buriganga, Dhaleshwari, Balu and Shitalakhya are the important ones. For this reason, a large number of industries are established in Dhaka City. Tongi is one the largest industrial zones of Dhaka. Tongi is primarily known and developed as industrial zone according to the Master Plan of 1959. Industrial purpose is one kind of dominating land use in Tongi area. Various categories of industries include metal industries, garments, jute, textile; spinning, pharmaceutical, food manufacturing industry etc. are in Tongi area.

This zone is situated near the river Turag. Industries which produce hazardous waste must need ETP (Effluent Treatment Plant). But most of the industries in Tongi don't have waste management facility like ETP. These industries dispose waste water (i.e. effluent) without proper treatment.

The properties of industrial wastewater or water can be classified into three groups.[5]These are-

- Physical properties(such as temperature, color, odors, solids)
- Chemical properties(such as Organic Substances- Surfactants ,Phenols, Volatile organic compounds, Inorganic Substances- pH , turbidity, dissolved oxygen, BOD, alkalinity)
- Heavy metal properties(arsenic, lead, mercury, zinc, copper, chromium, cadmium etc.)

Various types of heavy toxic component are disposed from different kinds of industries which are harmful for environment as well as human body if these wastes are not treated in a proper way.

Untreated & partially treated effluent causes environmental pollution as well as health hazards. Rivers also get polluted by this untreated effluent. Polluted water is unsafe for both humans and animals. Industrial wastes are known to adversely affect natural life by direct toxic action. Due to pollution the ecological balance of the river is changing & fish growth rate is decreasing.

Turag is one of the most important rivers in Dhaka city. The water of Turag is used in different purpose like drinking, bathing, washing, navigation, agriculture, irrigation etc. But now Tungi river faces many problems due to industrial effluent. At the same time people who live in the surrounding environment also face many problem or health problem such as skin disease, diarrhea, cough and cold, fever, gastric ulcer and chronic disease etc. So it is necessary to take immediate steps to prevent the Turag river from pollution and to protect the environment, human fishes and aquatic lives.

So as to assess the quality of both industrial effluent & river water & to create awareness among people about the adverse effect of river pollution, the study is selected.

1.3 Problem Statement

Industries dispose their liquid effluent directly in Turag river. Most of the people suffer from different skin disease, gastric ulcer, dysentery etc. due to this effluent. Physiochemical parameters of the river are changing day by day and doing the harm. Most important problem is that impact of this effluent on human health increasing day by day. Most of the industries in Tongi Industrial Area don't have ETP (effluent treatment plant). Some industries have ETP but these are not in operation. Not maintaining the standard water quality of liquid effluent.

1.4 Research question:

What is the water quality status of Turag river due to the industrial effluent?

1.5 Objectives of the Study

From the above discussion, the following objectives have been selected for the present study.

General objective:

- To assess the water quality status of Turag river due to the industrial effluent.

Specific objective:

- To identify the physiochemical parameters and heavy metal of Turag river water.
- To assess the physiochemical parameters and heavy metal of industrial effluents.

- To observe the effects of Turag river water quality on surrounding environment.

1.6 Scope of the Study

- This study will compare different water parameter of Turag river with their standard values.
- This study will be applicable for determining the effect on Turag river by industrial wastewater.

2. LITERATURE REVIEW

2.1 General

Industrial wastewater is one of the key issues in the pollution of our environment. It has become a great threat to our country as well as whole world. Everyday a huge amount of wastewater was discharged into water body. These cause serious water pollution in our environment as well as create negative effects to our human life and ecosystem.

2.2 Previous Study

Much research work was conducted on various steams in Bangladesh, which is effect, by industrial effluent, untreated urban sewerage, unplanned industrialization, urbanization. It has been done on the water quality of various streams, river. Some of this work is discussed here.

A research work done of water pollution of Turag river by Rahman and Islam. They found that standard CO2 and Alkalinity are very large in Turag river which is harmful for human and aquatic life. They suggest that factories and industrial waste are firstly treated and finally disposed into the river. [6]

Another study was conducted by H. M. Zakir, Sharmin Shila and Shikazono Naotatsu in 2006 to investigate the heavy metal contamination of water and sediments of Turag River at Tongi area. Untreated urban sewerage and industrial wastewater from Tongi area affect water chemistry of

This part of the Turag River. The results showed heavy metal concentrations in the water greatly exceeding the standard values for the surface water quality. The mean concentrations of Mn, Zn, Cr, Cu and Pb in the sediment sample were higher than the standard. The enhanced metal concentrations are related to the direct discharge of the industrial and municipal wastes into the river. [7]

According to an industrial survey conducted by Bangladesh Center for Advanced Studies (BCAS) in 2009, only about 40% industries have ETPs. In 10% industries, ETPs are under construction and about 50% industries have no ETP establishment. That is, more than 50% of waste generated by the industries eventually goes to the rivers untreated.

The same type of study was conducted by Islam et al., 2012 to investigate the effects of solid waste and industrial effluents on the water quality of Turag River. Results of the study showed that the color of water was light to dark black and emitted noxious smell due to the industrial effluents. The upstream water was slightly alkaline with comparatively high DO content while low concentration of other parameters. The continuous dumping of waste materials resulted in a marked increase in the concentration of metals in the river water varied in the order of Fe > Zn > Pb > Cu > Cd. They found that the downstream water in the river was almost polluted and unsuitable for human consumption and aquaculture purposes [8].

Hossain, Salam & T. Islam also conducted a thorough study on Turag River. The aim of the study is to investigate the extent of pollution of the Turag River. The study was conducted within the Tongi Bridge to Ejtema Field,since this portion of river is highly polluted. They assess five heavy metal (Pb, Cd, Cu, Cr and Zn) concentration on the river water & shows strong correlation's between them. The study shows that the river is facing pollution and the water, sediment and fish are not completely safe for health [9].

Same type of research was conducted by Mobin et al. on Turag river. They studied of physical and chemical properties of Turag river water. For those purpose water was collected at three points of investigate. They found that the physicochemical parameters of water exceed the standard value. The river water was black in color and the odor was bad which indicate that the water is polluted and dangerous for aquatic ecosystem and human health. They recommended that the water quality of the Turag River is beyond the acceptable limit. So, effective measures should be taken to reduce the level of pollution and mitigate the existingaquatic environmental problems of the Turag River [10].

Nizel & Islam was conducted a study to find out the pollution situation of Turag river and the health problem of the surrounding residents. They found that the water quality of Turag river may not be in a position to sustain the aquatic life and not suitable for using domestic purpose. This is indicated by the very low dissolved oxygen (DO) levels and other measured parameters in the river. The maximum concentration of turbidity, BOD, hardness, TDS, and COD found in the Turag river is much higher than the standard permissible limit. They also provide evidence that local communities are suffering from a variety of health problems including skin, diarrhea, dysentery, respiratory illnesses, anemia and complications in childbirth. Yellow fever, cholera, dengue, malaria and other epidemic diseases are also available in this area. Furthermore, the people are suffering by the odor pollution and respiratory problems [11].

Sultana et al. was conducted a study on implementation of Effluent Treatment Plants for waste water treatment. They found that most of river of Bangladesh is heavily polluted by the discharge from different kinds of industries. They suggest that diverting the municipal drains in the vicinity to other place, the owners of industries must be treated their waste before discharging it into the river [12].

Previous study shows that physiochemical properties & heavy metal of Turag river are much higher than the standard value & local communities are suffering from a variety of health problems including skin, diarrhea, dysentery, respiratory illnesses, anemia and complications in childbirth. Furthermore, the people are suffering by the odor pollution and respiratory problems. Necessary steps should be taken to mitigate this pollution.

3. METHODOLOGY

3.1 General

Major environmental hazards present in various industries are the discharge of untreated effluent to the environment causing pollution of nearby canals & rivers. Most industries do not have effluent treatment facilities and few industries which have these facilities are either not properly designed or operated regularly. They pollute natural water systems as well as ground water endangering human health and aquatic lives. They contain heavy metals like As, Cd, Pb, Hg, Cr, Ag, Cu, Zn etc. Some of them are toxic to plants and some others to both plants and animals.

3.2 Study Time:

The total study period was 10th May to 10th August 2016. I had collected sample 11th May 2016 and result collected from 12th to 20th May 2016.

3.3 Work Flow Diagram

The total work has been done by the following ways which are given in Figure 3.1.

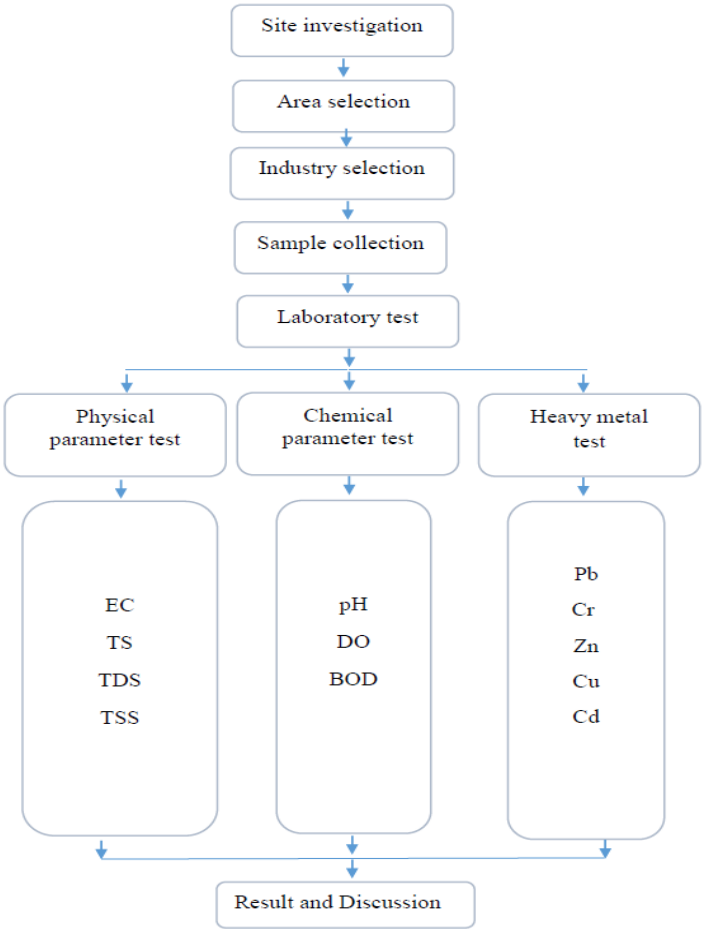

Figure3.1: Work flow Diagram of the Present Study

3.4 Selection of the Area

There are two major industrial areas in Dhaka. One is 'Dhaka Export Processing Zone (DEPZ)' and the other is 'Tongi Heavy Industrial Area'. We select 'Tongi Heavy Industrial Area' showed in Figure 3.1 because it is situated beside the river Turag. Garments, Textiles, Washing, Dying, Chemicals, Oil mills, Plastic, Painting, Electronics, Poultry, Foods, Cement etc. industries are present in this area. The industries dispose their effluent directly or indirectly in 'Turag River'.

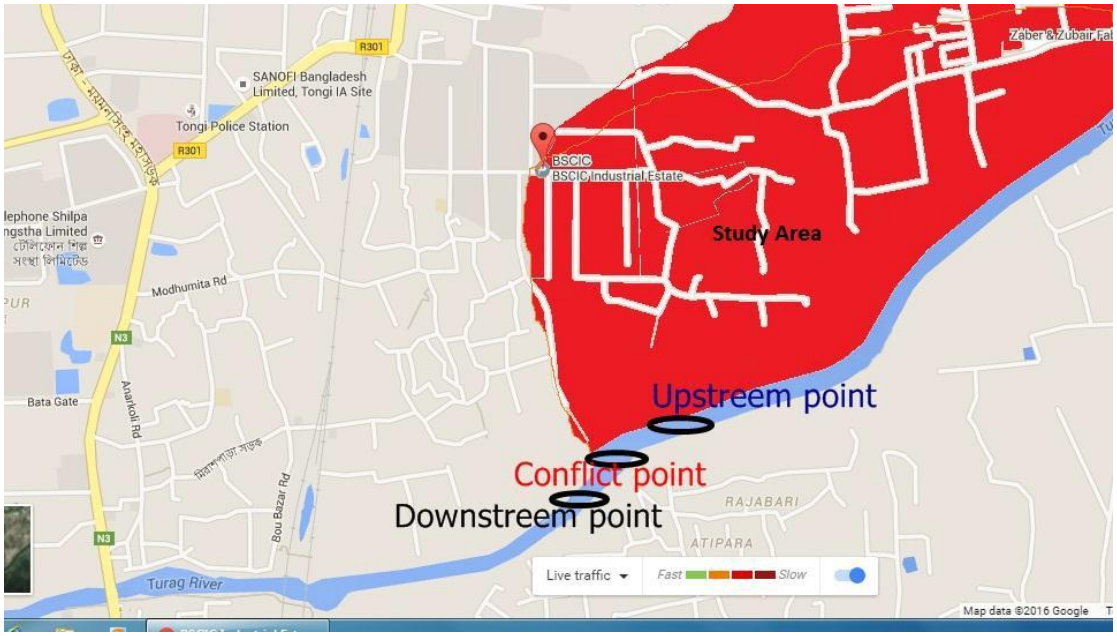

Figure3.2: Tongi Heavy Industrial Area (Source:Google Map)

3.5 Selection of the Industry

There are about 240 industries present in Tongi Heavy Industrial Area. Garments, Washing, Dying, Chemicals, Oils, Plastic, Poultry, Sea food, Electronics, painting, printing etc industries are available here. Among the 240 industries four industries were selected purposively. Among them I had selected following four industries

- Octogan Fiver and Chemicals Ltd.
- Hossain dying Ltd**.**
- Fin Fashion Ltd.
- Bellye Shema apparels Ltd**.**

These are selected because these are situated near the Turag river and they are directly dispose the industrial waste into the river.

3.6 Sample Collection

In order to evaluate the industrial liquid effluent samples are collected through 'purposive convenient sampling' method from the discharge point of different industries. To evaluate the river water quality samples are collected from at the confluence point of disposal drain & Turag river, 50m upstream & 50m downstream from confluence point. Samples were collected in plastic bottles in pouring condition & those samples were tested in laboratory within 24 hours.

For collecting samples, I have concern on some parameters. I had collected the samples from the outlet of the industry. For collecting the samples I had used some plastic bottles, it was cleaned carefully and carried in a plastic bag. To collect water from outlets I had to use boat. I had handled the sample in a manner that prevents them from decomposing or being contaminated prior to their analysis. I had filled up sample containers in such a way that no air enters into it. I had carefully collected samples containing metals. I had made labeling of samples. I had taken adequate precautions when collecting and handling, it includes the use of protective apparel, gloves, and safety glasses. In the laboratory, sample is preserved carefully in refrigerators.

The physiochemical parameters were tested in Water Research Centre, Jahangirnagar University, Savar, Dhaka & heavy metals were tested in Wazed Miah Science Research Centre (WMSRC), JU.

3.6.1 Physical Parameters Determination

i) Determination of Electrical Conductivity (EC): Electrical Conductivity (EC) valueswasrecordedbyEC(ElectricalConductivity)meter&expressedbytheunit µS/cm.

ii) Determination of Total Solids (TS), Total Dissolved Solids (TDS), Total suspended solid (TSS): TDS give the total concentration of dissolved solids in a water sample. The TDS of water sample was determined by using a Pual Smith Digital TDS Meter.Unit of all these parameters are in mg/l.

3.6.2 Chemical Parameters Determination

i) Determination of pH

The acidic or alkaline condition of the water is expressed by pH. The pH of water sample was determined by using a glass electrode pH meter (Griffin pH meter, model No.40). The electrode was rinsed thoroughly using distilled water and wiped by using tissue paper. The electrode was dipped into the sample water and was kept until the stable reading was observed. The final reading was recorded.

ii) Determination of Dissolved Oxygen (DO)

Standard Method 4500-O describes two methods for determination of dissolved oxygen (DO) in water: Winkler's iodometric method and the electrometric method (Standard Methods, 1998). I had used the iodometric method because it is very accurate and precise. Unit of DO is mg/l.

iii) Determination of BOD

One of the most important characteristics of wastewater is the amount of oxygen required to stabilize it. This quantity is called the oxygen demand, and is determined either as biological oxygen demand (BOD) or chemical oxygen demand (COD). BOD is the quantity of oxygen required to stabilize wastewater in the presence of bacteria that consume the chemical pollutants and oxygen in the sample and can be determined by Standard Method 5210 (Standard Methods, 1998). I also used this method to determined BOD. Unit of BOD is mg/l.

3.6.3 Heavy Metal Determination

There are many methods for metal determination (Standard Methods, 1998: section 3000). Some, for example as gravimetric, titrimetric or colorimetric methods, are most effective at high metal concentrations. Others, for example atomic absorption (AA), inductively coupled plasma (ICP) or inductively coupled plasma mass spectrometry (ICPMS) are far more sensitive.

3.7 Data analysis

Data was entered into excel spread sheet and were analyzed by Excel 2007. One table for each question was made . Results were presented by table and figure. A total view was found in this way.

4. RESULT

4.1 General

Investigation of the study area includes physical and experimental investigation of the study area. Evaluation includes determination of PH, Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD5), Total Solids (TS), Total Dissolved Solids (TDS), Electrical conductivity (EC) and different types of heavy metal parameters like ,Zn, Cu, Cr, Cd, Pd. Investigation also covers the comparison of experimental values with Bangladesh standards with respect to inland surface water quality.

4.2 Physical Assessment

Physical investigations are discussed here as follows:

4.2.1 Name & Types of Industries

There are four industries in two categories. These are given below:

1. **Chemical –**Octogan Fiver And Chemicals Ltd.
2. **Dying –** Hossain dying Ltd**.**
   Fin Fashion Ltd.
   Bellye Shema apparels Ltd**.**

4.3 Experimental Assessment

In order to evaluate the industrial effluent samples are collected from four industries and water sample are collected from confluence point of drainage water & Turag river, at 50m upstream & 50m downstream from the confluence point.

4.3.1 Assessment of P^H

PH value of four industries and three stationery points on Turag river are given in figure 4.1 & Table 4.1 respectively.

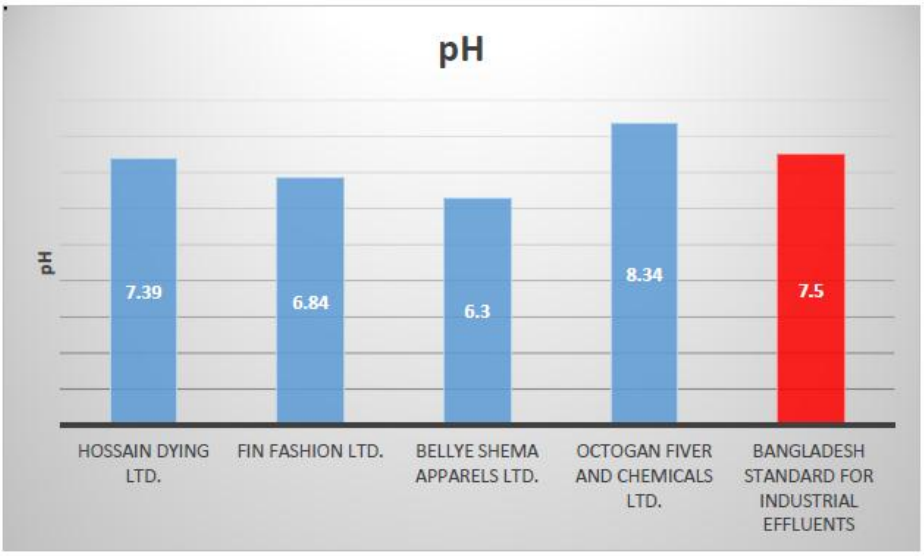

Figure4.1:Distribution of $P^H$of Various Industries

This figure shows that Hossain Dying Ltd. has pH 7.39, Fin Fashion Ltd. has pH 6.84, Bellye Shema Apparels Ltd. has pH 6.3, Octogan Fiver and Chemical Ltd. has pH 8.34 whereas Bangladesh standard of pH is 7.5.

Table 4.1:Distribution ofP^HofTurag River

Location :Turagriver	pH
Upstream (50m)	7.16
ConfluencePoint	7.45
Downstream (50m)	7.10

According to this table the value of pH in Upstream (50m)=7.16, Confluence Point =7.45, Downstream (50m)=7.10 of Turag river.

4.3.2 Assessment of Dissolved Oxygen (DO)

DO value of four industries and three stationery points on Turag river are given in figure 4.2 & Table 4.2 respectively.

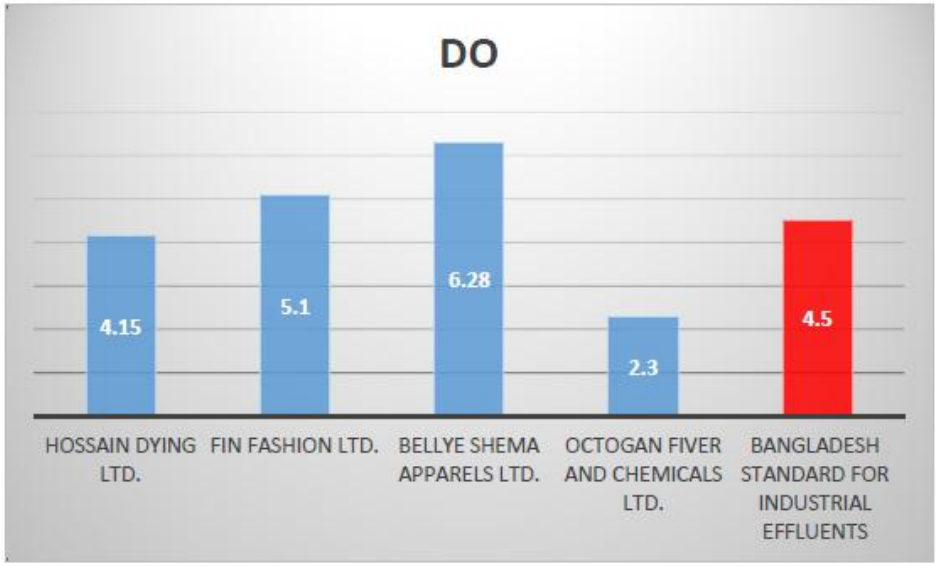

Figure4.2:Distribution of DO of Various Industries

From this figure it is evident that Hossain Dying Ltd. has DO 4.15, Fin Fashion Ltd. has DO 5.1, Bellye Shema Apparels Ltd. has DO 6.28, Octogan Fiver and Chemical Ltd. has DO 2.3 whereas Bangladesh standard of DO is 4.5.

Table 4.2: Distribution of DO of Turag River

Location : Turag river	DO(mg/l)
Upstream (50m)	4.20
Confluence Point	1.85
Downstream (50m)	2.32

This table indicates that the value of DO in Upstream (50m)=4.20, Confluence Point =1.85, Downstream (50m)=2.32 of Turag river.

4.3.3 Assessment of BOD

BOD value of four industries and three stationery points on Turag river are given in figure 4.3 & Table 4.3 respectively.

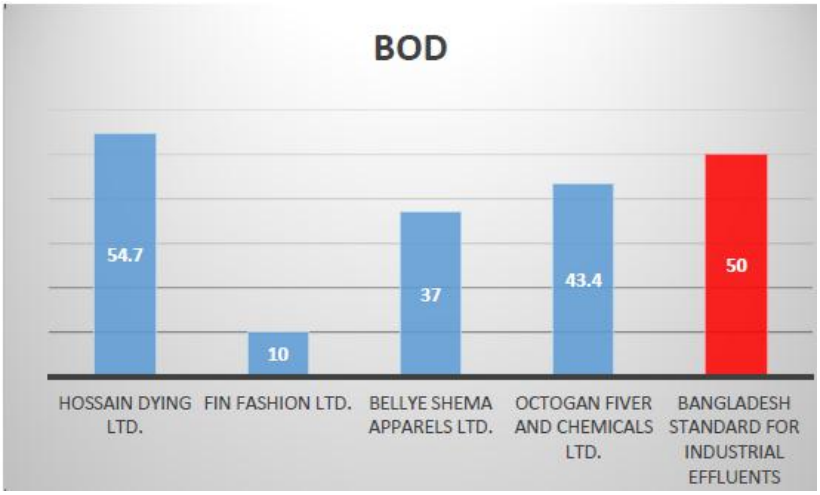

Figure4.3:Distribution of BOD of Various Industries

This figure indicate that the value of BOD in Hossain Dying Ltd. =54.7, Fin Fashion Ltd.=10, Bellye Shema Apparels Ltd. =37, Octogan Fiver and Chemical Ltd.=43 & Bangladesh standard of BOD is 50.

Table 4.3:DistributionofBOD ofTurag River

Location : Turag river	BOD(mg/l)
Upstream (50m)	13
Confluence Point	73
Downstream (50m)	46

This table shows that BOD value in Upstream (50m)=13, Confluence Point =73, Downstream (50m)=46 of Turag river.

4.3.4 Assessment of Total Solid

Value of Total Solid of four industries and three stationery points on Turag river are given in figure 4.4 & Table 4.4 respectively.

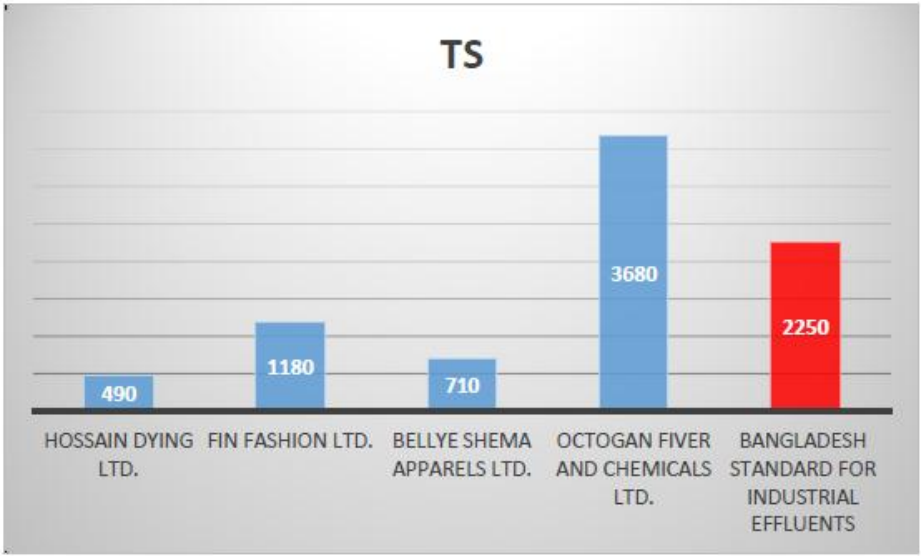

Figure4.4:Distribution of Total Solid of Various Industries

The following figure show that Hossain Dying Ltd. has low TS 490, Fin Fashion Ltd. has TS 1180, Bellye Shema Apparels Ltd. has TS 710, Octogan Fiver and Chemical Ltd. has high TS 3680 & Bangladesh standard of TS is 2250.

Table 4.4:Distribution of Total Solid of Turag River

Location :Turag river	TS(mg/l)
Upstream (50m)	920
Confluence Point	870
Downstream (50m)	846

According to this table the value of TS in Upstream (50m)=920, Confluence Point =870, Downstream (50m)=846 of Turag river.

4.3.5 Assessment of Total Dissolved Solid

Value of Total Dissolved Solid of four industries and three stationery points on Turag river are given in figure 4.5 & Table 4.5 respectively.

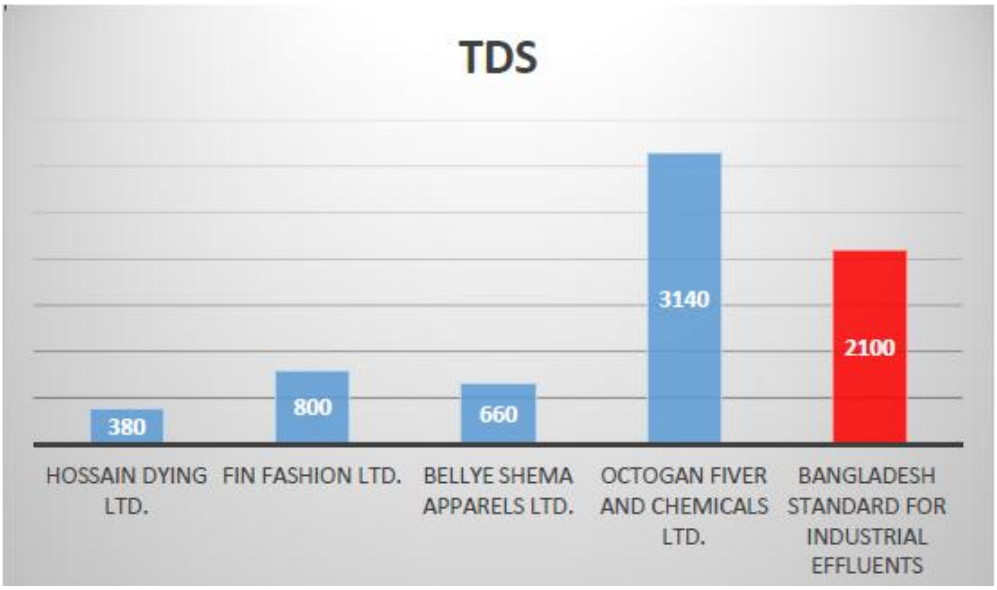

Figure4.5:Distribution of Total Dissolved Solid of Various Industries

This figure indicate that the value of TDS in Hossain Dying Ltd. =380, Fin Fashion Ltd.=800, Bellye Shema Apparels Ltd. =660, Octogan Fiver and Chemical Ltd.=3140 & Bangladesh standard of TDS is 2100.

Table 4.5:Distribution of Total Dissolve Solid of Turag River

Location : Turag river	TDS(mg/l)
Upstream (50m)	655
Confluence Point	613
Downstream (50m)	582

According to this table the value of TDS in Upstream (50m)=655, Confluence Point =613, Downstream (50m)=582 of Turag river.

4.3.6 Assessment of Total Suspended Solid

Value of Total Suspended Solid of four industries and three stationery points on Turag river are given in figure 4.6 & Table 4.6 respectively.

Figure4.6:Distribution ofTotal SuspendedSolidofVarious Industries

This figure shows that Hossain Dying Ltd. has TSS 110, Fin Fashion Ltd. has TSS 380, Bellye Shema Apparels Ltd. has TSS 50, Octogan Fiver and Chemical Ltd. has TSS 540 whereas Bangladesh standard of TSS is 150.

Table 4.6:Distribution of Total Suspended Solid of Turag River

Location : Turag river	TSS(mg/l)
Upstream (50m)	265
Confluence Point	257
Downstream (50m)	264

This table show that the value of TSS in Upstream (50m)=265, Confluence Point =257, Downstream (50m)=264 of Turag river .

4.3.7 Assessment of Electric Conductivity (EC)

Value of Total Electric Conductivity (EC) of four industries and three stationery points on Turag river are given in figure 4.7 & Table 4.7 respectively.

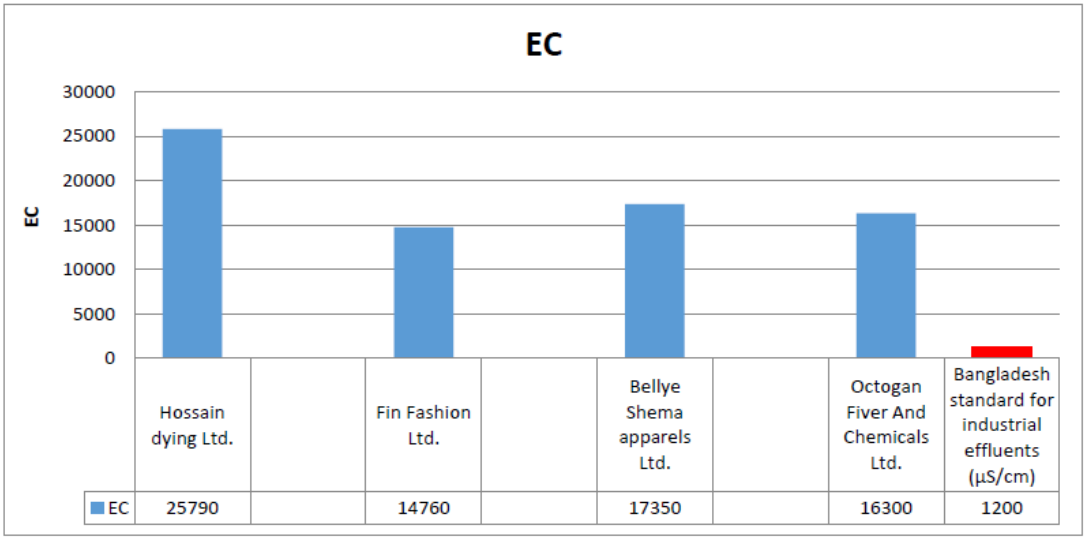

Figure 4.7: Distribution of Electric Conductivity of Various Industries

This figure indicate that the value of EC in Hossain Dying Ltd. =25790, Fin Fashion Ltd.=14760, Bellye Shema Apparels Ltd. =17350, Octogan Fiver and Chemical Ltd.=16300 & Bangladesh standard of EC is 1200.

Table 4.7:Distribution of Electric Conductivity of Turag River

Location : Turag river	EC (µS/cm)
Upstream (50m)	340
Confluence Point	610
Downstream (50m)	485

This table indicate that the value of EC in Upstream (50m)=340, Confluence Point =610, Downstream (50m)=485 of Turag river .

4.3.8 Assessment of Heavy Metals

Heavy metal value of Turag river is tabulated in Table 4.8.

Table 4.8:DistributionofHeavy Metals ofTuragRiver

Parameters	Unit (mg/l)	Bangladesh Standards for Industrial Effluents
Pb	0.073-0.1	0.1
Zn	0.019-0.065	5
Cu	0.047-0.05	0.5
Cr	0.039-0.061	-
Cd	0.002-0.003	0.5

This table show that the value of heavy metals of Turag river is Pb=0.073 to 0.1 & Bangladesh Standards is 0.1,Zn=0.019 to 0.065 & Bangladesh Standards is 5,Cu=0.047 to 0.05 & Bangladesh Standards is 0.5, Cr=0.039 to 0.061,Cd=0.002 to 0.003 & Bangladesh Standards is 0.5.

5. DISCUSSION

The result obtained on some physicochemical parameters and heavy metal of the Turag river water samples and Industrial effluents.

The value of PH of the analyzed industrial samples are within the range of 6-9. These value remains within the Bangladesh standard. PH value of the river is also in the tolerable limit. The pH value varied from 7.10 to 7.45 which is within the permissible limit for diverse uses like irrigation, domestic and recreational, according to standard value of DoE (pH 6 to 9). The normal range for pH in surface water systems is 6.5 to 8.5 and for groundwater systems 6 to 8.5.[13] pH greatly affects biological activity. It also affects some properties of water body, activity of organism and effectiveness of toxic substances present in the aquatic environment.

An adequate supply of dissolve oxygen is essential for the survival of aquatic organism. Dissolved oxygen (DO) is needed for waste degradation and decomposition by microorganism. Fish in water containing excessive dissolved gases may suffer from "gas bubble disease"; however, this is a very rare occurrence. The bubbles or emboli block the flow of blood through blood vessels cause death. On the other hand, the decrease of dissolve oxygen concentration is dangerous for aquatic life. The value of DO of the analyzed industrial samples are within the range of 2.32-6.28.In chemical industries DO value is lower than the standard. But

in other conditions DO value is higher. DO value of the river is also lower than the Bangladesh standard. Dissolve oxygen (DO) values are found in the range from 1.85 to 4.20 mg/L . The highest value

6 mg/L for DO was found in 2006 decreased to 1.85 to 4.2 mg/L in the present study. This reduction in value is due to high discharge of organic material, e.g. from sewage treatment works, storm overflows, agricultural slurry, silage liquor. Such low value do not supports the survival of aquatic life. Enrichment by nutrients results in lower oxygen levels leading to eutrophication. According to the environmental quality standard (EQS), the following requirements for DO are prescribed: 6 mg/L for drinking, 4 to 5 mg/L for recreation, 4 to 6 mg/L for fish and livestock and 5 mg/L for industrial application.

When BOD levels are high, dissolved oxygen (DO) levels decrease because the oxygen that is available in the water is being consumed by the bacteria .[14] Since less dissolved oxygen is available in the water, fish and other aquatic organisms may not survive. If there is no organic waste present in the water, there would not be as many bacteria present to decompose it and thus the BOD will tend to be lower and the DO level will tend to be higher. The value of BOD of industrial sample ranges from 10 to 54.7. Higher BOD values were found in Confluence Point of Turag river .The values BOD ranging from 13 to 73 mg/L. The permissible limit for BOD for drinking water is 0.2 mg/L, for recreation 3 mg/L, for fish 6 mg/L and 10 mg/L for irrigation. (Bangladesh standard) (DoE, Department of Environment, 1991, 1997). The biological oxygen demand (BOD) was high because most of the industries are situated near the bank of the river. They discharge organic material, e.g. from sewage treatment works, storm overflows, domestic waste water (human waste and food waste) and industrial waste water (from tannery, textile and food processing industries), agricultural slurry, silage liquor. Moreover, municipal waste materials directly or within the sewerages are dumped into the bank of the river.

The total dissolved solids (TDS) mainly indicate the presence of various kinds of minerals like ammonia, nitrite, nitrate, phosphate, alkalis, some acids, sulphates and metallic ions etc. which are comprised both colloidal and dissolved solids in water. It is also an important chemical parameter of water [15]. TS, TDS values of the river water are within the standard but TSS value of every river water sample is higher than the Bangladesh standard. In industries TSS values are also higher. Some TS & TDS values are within the standard in different industries. The TDS values of the study area lies between 580 and 655mg/L.

The electrical conductivity (EC) is usually used for indicating the total concentration of charged ionic species in water. The total study area reveals the low condition for EC . High EC shows that a large amount of ionic substances like sodium, iron, potassium etc which are present in industrial effluent. The values in all measuring water samples , were in accordance with FAO drinking water standard (1000 µs/cm).

Presence of heavy metals in the water samples experimented were illustrated in Table 4.8. The value of heavy metals Pb,Zn, Cr, Cu, Cd are as follows: (0.073 to 0.1 , 0.019 to 0.065, 0.039 to 0.061, 0.047 to 0.05 and 0.002 to 0.003 mg/L. At all studied points heavy metals values are lower compared to permissible limit representing at present no significant threat to the ecosystem. All heavy metal parameters are within the Bangladesh Standard for Turag river water.

5.2 Limitations of the study

Like any other study the present study was not without limitations. A major limitation of my study was it was wet season when I collected my sample. So, my sample was diluted, it affects my study. I didn't have enough lab facilities to conduct all the parameters which I should have tested.

6. CONCLUSION AND RECOMMENDATION

From the above study it can be concluded that most of the industrial pollutants are directly or indirectly discharged into Turag River. Turag river is polluted by industrial effluent, untreated sewage, wastewater, oil dumping, silt, encroachment etc. Pollutants entering the water body are both in solid and liquid forms. Concerning all measured parameters (especially DO, BOD), it could be concluded that pollution of Turag water reached critical point with increasing tendency day by day. Consequently, in order to decrease pollution from various sources appropriate steps must be taken immediately. If the necessary steps are not taken, very soon it would be a source danger point for water pollution. This study has revealed that the industries are involve in serious environmental hazard. Adequate preventive measures should be taken in industrial activities with a view to ensuring a healthy environment. The adverse effect of industries are severe. But considering the economical benefit we cannot ignore this sector. Some recommendations are given below to mitigate this problems. It is recommended that Effluent Treatment Plant (ETP) for every industry must be made necessary. Desire degree of treatment of effluent to achieve the standard. Proper operation & maintenance of ETP should be monitored continuously.

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